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Langley Research Center



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Horn Antenna With V-Shaped Corrugated Surface

The corrugated horn antenna characteristics are low side and back lobes, a rotationally symmetric radiation pattern, and broadband performance. These properties are particularly useful in low noise applications such as feed horns for reflectors and radiometer antennas. The usual corrugation is rectangular in shape. A new corrugation shape (see illustration) is more easily machined for millimeter wave application and is better suited for folding antenna design. A parametric study, using an integral equation solution, is available for both the rectangular and new V-shaped corrugations.

The study involved looking into the influence of corrugation density and shape on the power loss, surface current, and scattering from a ground-plane corrugated surface junction. It shows that for operation as a cutoff corrugated surface the "V" corrugation depth should lie between 0.3125λ and 0.625λ (λ = wavelength). For the rectangular corrugations the corresponding depth range is 0.25λ to 0.5λ . The radiation patterns for both corrugations are nearly independent of the corrugation density (corrugations per wavelength), and the direction of maximum intensity decreases with increasing corrugation depth.

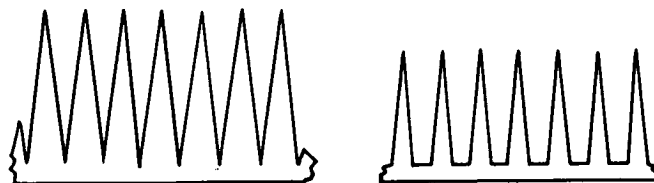
The "V" corrugations have a higher relative power loss. For example, at the minimum corrugation depth-to-wavelength ratio, $d/\lambda = 0.25$ (rectangular) and $d/\lambda = 0.3125$ ("V"), the "V" corrugation loss is

approximately 6.5 dB larger. If low loss is important, the first few "V" corrugations should be polished or silver plated. For a foldable antenna the first part may be rigid and rectangular corrugations may be used to obtain lower loss, while the remainder would be the folding "V" corrugations. In any event, the loss in a corrugated horn would be equal to or less than the loss in a conducting wall made of the same material and having the same shape and surface finish.

A "V" corrugation horn has been built, and its performance has been compared with a rectangular corrugation horn of the same shape. Both horns were designed for C-band operation (3.95 to 5.85 GHz). The E-plane contained the corrugations and was flared at 36.1° . The H-plane was flared at 33.12° , and it had a slant length of 42.19 cm (16.609 in.) with a 4.75-cm (1.872-in.) waveguide feed. Measured performance showed that the new "V" corrugations and rectangular corrugations have nearly the same pattern beamwidth, gain, and impedance.

Notes:

1. The analytical study, contained in the following report, may be obtained from:
National Technical Information Service
Springfield, Virginia 22151
Single document price \$4.25
(or microfiche \$2.25)
Reference: NASA CR-2317 (N73-32059), A Parametric Study of Cut-Off Corrugated Surface Properties



V-Shaped Corrugated Surface

(continued overleaf)

2. The experimental comparison results may be obtained from and technical questions may be directed to:

Technology Utilization Officer
Langley Research Center
Mail Stop 139-A
Hampton, Virginia 23665
Reference: B74-10260

Patent status:

This invention is owned by NASA, and a patent application has been filed. Inquiries concerning non-exclusive or exclusive license for its commercial development should be addressed to:

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